Khulna University Studies Volume 19(2): 235-244 : 2022

ORIGINAL ARTICLE

SOCIAL SCIENCE

LIFESTYLE FACTORS AND RISK OF OBESITY AMONG THE SCHOOL CHILDREN IN KHULNA CITY

Shahinur Akter* and Taslima Akter Bristy

Sociology Discipline, Khulna University, Khulna-9208, Bangladesh

KUS: 21/47: 05122021

Manuscript submitted: December 5, 2021 Accepted: July 25, 2022

Abstract

As childhood obesity is increasing in urban areas, this study was designed to explain the association of lifestyle-related factors with obesity among primary school children in the Khulna City of Bangladesh. Data were collected from 257 purposively selected mothers of primary school children. A semi-structured interview schedule was used for data collection during February and March 2019. Findings indicated that a significant proportion of the teenagers were obese (44%). Results from regression analysis revealed that children having health problems, frequency of meals taken per day, and time spent in outdoor games have a significant association ($p < 0.05$) with childhood obesity. Moreover, children having health problems (AOR = 4.941; 95% CI: 2.273-10.745; $p < 0.001$), taking meals more than three times in a day (AOR = 24.534; 95% CI: 10.024-60.046; $p < 0.001$), and spending less time in outdoor games (AOR = 2.736; 95% CI: 1.242-6.028; $p < 0.05$)) were more likely to be obese. The study suggests that parents should motivate their children to adopt a healthy lifestyle. In addition, adequate playgrounds for children can help to prevent obesity and should be prioritized in the management of childhood obesity.

Keywords: Obesity, lifestyle, children, dietary habit, physical activity

Introduction

Childhood overweight and obesity have become serious public health problems in both developed and developing countries, including Bangladesh, because of their robust association with adulthood obesity (Rachmi et al., 2017; Raychaudhuri & Sanyal, 2012). Adverse health consequences such as the high prevalence of blood pressure, diabetes, respiratory disease, and orthopedic and psychosocial disorders are related to obesity (Koirala et al., 2015; Mirelman et al., 2012). It is also related to an increased risk of morbidity and mortality as well as reduced life expectancy (Hasanat et al., 2019). However, the worldwide prevalence of overweight and obesity amongst children and adolescents within the age group of 5 to 19 years was over 340 million in 2016 (World Health Organization, 2020).

However, childhood obesity has been attributed to many factors. Lifestyle-related factors are the significant ones that lead to obesity amongst children. Due to rapid urbanization and modernization, changes in childhood lifestyle, characterized by an increase in the consumption of energy-dense foods and physical inactivity, lead to a global obesity epidemic that poses significant public health challenges (Hasanat et al., 2019). Several studies identified a variety of lifestyle-related risk factors for obesity including dietary habits (Mahfouz et al., 2011), physical activity (Ahmed et al., 2016; Al-Nuaim et al., 2012), sedentary behaviours, screen time (Al-Ghamdi, 2013), and duration of sleep (Al-Hazzaa et al., 2012).

Several factors related to eating habits and food choices have contributed to the incidence of obesity among children, particularly the regularity of skipping breakfast, sugar-sweetened drinks, fruit and vegetable consumption, sweet and candy consumption (Hammad & Berry, 2017), consumption of fast food and soft drinks (Abduelkarem et al., 2020; Rahman et al., 2014; Saha et al., 2011; Xu et al., 2018).

*Corresponding author: <shahinursoc09@gmail.com>

DOI: https://doi.org/10.53808/KUS.2022.19.02.2147-ss

Physical activity is an important factor contributing to obesity, particularly in children (Al-Nuaim et al., 2012). Physical inactivity increases the risk of child obesity (Alazzeh et al., 2018; Hasanat et al., 2019; Hills et al., 2011). Television viewing and playing computer games could contribute to the increasing rate of obesity by replacing time for physical activity as well as increasing food consumption (Al-Agha et al., 2016; Alghadir et al., 2016; Desalew et al., 2017; Hossain et al., 2020). Sleep duration is another important lifestyle-related factor that has been studied in association with obesity (Ahmed et al., 2016; Piryani et al., 2016). As modern lifestyles give access to smartphones, television, and video games round the clock for teenagers, that ultimately affects their sleep health (Al-Hazzaa & Albawardi, 2019).

Due to rapid urbanization and modernization, the lifestyles of all age groups are changing day by day. The availability of fast food and limited or no space for physical activities triggers the risk of obesity among teenagers in urban areas. However, childhood obesity is a serious concern in developing countries like Bangladesh, especially in urban areas that remain unexplored. Thus, the present study aims to explain the association of lifestyle-related factors with child obesity in the Khulna City of Bangladesh. Moreover, this study will help to further policy interventions as well as add a new dimension to the research area.

Materials and Methods

Due to the blessings of modern technology and urbanization, the lifestyles of children are changing, which ultimately stimulates the propensity for obesity among children. The study was explanatory as it tried to explain the lifestyle-related factors and their relation to obesity amongst primary school children in the Khulna City of Bangladesh. As childhood obesity is increasing in urban settings, six pre-primary and primary schools from the Khalispur region of Khulna City were purposively selected to conduct the study for two months (February-March 2019).

Data were collected from the mothers of school-going children aged 5 to 10 years in the aforesaid study area. Mothers were chosen because they are the primary caregivers and, at present, they usually come to the school with their children and stay at the school to pick them up. Due to children's safety, the principals of the selected schools in the study area did not provide the list of the children. As the size of the population was unknown, a total of 257 mothers were selected purposively for data collection.

A semi-structured interview schedule was followed for data collection. A pre-test on 18 mothers (3 mothers from each school) was conducted in February 2019 before the final data collection to minimize the inconsistency of the data collection tool, which was excluded from the results. Final data were collected by taking verbal consent from the respondents in March 2019.

Children's obesity was measured by their Body Mass Index (BMI). A digital weighing machine and a vertical scale were used to measure these parameters. Children's weight was measured in kilograms and height in meters. The BMI was determined from the ratio of weight (kg) to height (m) square. After that, their BMI was classified into four categories according to the Official Centre for Disease Control (CDC) growth chart for boys and girls aged 2 to 20 years (Kuczmarski et al., 2002) such as, underweight (<5th percentile), healthy weight (5th percentile to<85th percentile), overweight (85th percentile to <95th percentile) as well as obesity (≥95thpercentile) based on age and sex-specific BMI percentiles.

The outcome variable in this study was the child's BMI which was categorized into obese (≥95th) and non-obese (<95th percentile) in line with a prior study (Ganle et al., 2019). Among the predictors, we included several lifestyle-related factors such as preferred food (food away from home and homemade food), frequency of meals taken in a day (regular and irregular), consumption of fast food (regular and irregular), sweetened food (regular and irregular), and soft drinks (regular and irregular), time spent in outdoor games (physically active [<1 hour] and physically inactive [≥1 hour]), time spent on screen watching (≤2 hours and >2 hours), and sleep duration (<9 hours and ≥9 hours). These variables were considered in the present study as some prior studies found those variables to be significant determinants of child obesity, e.g., dietary habits (Abduelkarem et al., 2020; Hammad & Berry, 2017; Mahfouz et al., 2011), physical activity (Ahmed et al., 2016; Al-Nuaim et al., 2012), sedentary behaviours, screen time (Al-Ghamdi, 2013) and sleep duration (Ahmed et al., 2016; Al-Hazzaa & Albawardi, 2019; Al-Hazzaa et al., 2012).

On the contrary, the age of the children (5-6 years, 7-8 years, and ≥9 years), sex of the children (girl and boy), and having health problems (no and yes) were considered under demographic and health-related variables in this study. These variables were also found as significant predictors of childhood obesity in previous studies (Hajian-Tilaki & Heidari, 2013; Hassan et al., 2016; Júlíusson et al., 2010).

We analyzed the data using the Statistical Package for the Social Sciences (SPSS) version 20.0. The personal characteristics of the mothers and children were analyzed by percentage distribution. Pearson's chi-square ($\chi 2$) test was conducted to assess the significant association between outcome and predictor variables considering a $p < 0.05$ significance level. Later, binary logistic regression analysis was executed by considering the variables that were found statistically significant in the Chi-square test. Results of binary logistic regression were presented as adjusted odds ratios (AOR) with 95% confidence intervals (CI).

Results

Personal profile of the mother

The personal characteristics of the mother are presented in Table 1. The highest percent of the mother (56%) were aged between 28 to 34 years and 79 percent of them were Muslim. About 37 percent of the mother had a tertiary level of education. Most of the mothers were housewives (76.7%) and the rest of them (23.3%) were working mothers. Around three-fourths of the mother (76.7%) had been living in a nuclear family, and the majority of the family consisted of 3 to 4 members. Nearly 40 percent of the respondents' monthly household income was more than BDT 40,000.

Table 1. Personal characteristics of mothers

Variables	Number of the mother(n=257)	Percent (%)
Age of mother (in years)		
21-27	60	23.4
28-34	144	56.0
≥35	53	20.6
Religion		
Muslim	203	79.0
Non-Muslim	54	21.0
Education of mother		
Primary (1-5)	4	1.6
Secondary (6-10)	75	29.2
Higher secondary (11-12)	81	31.5
Tertiary (≥13)	97	37.7
Occupation of mother		
Housewife	197	76.7
Working mother	60	23.3
Nature of the family		
Extended	60	23.3
Nuclear	197	76.7
Size of the family		
3-4	180	70.0
≥5	77	30.0
Monthly household income (in BDT)		
≤30000	82	31.9
30001-40000	73	28.4
>40000	102	39.7

Personal profile of the children

Data presented in table 2 reveals that the majority of the children (35.8%) were aged between 5 and 6 years, and more than half (52.1%) of them were boys. About 64 of the children were studied at the primary level, and the remaining children were studied at the pre-primary level of education. Nearly three-fifths of the children did not have any health problems, and the rest of them were suffering from health problems. Regarding the BMI of the children, a significant portion of the children was obese (44%) and 56 percent were non-obese.

Table 2. Personal characteristics of the children

Variables	Number of the children	Percent (%)
Age of the children (in years)		
5-6	92	35.8
7-8	90	35.0
≥9	75	29.2
Sex of the children		
Girl	123	47.9
Boy	134	52.1
Area of study		
Pre-primary (Nursery and KG)	93	36.2
Primary (One to Five)	164	63.8
Having health problems		
No	155	60.3
Yes	102	39.7
BMI of the children		
Obese	113	44.0
Non-obese	144	56.0

Association of lifestyle factors with child obesity (Bivariate analysis)

Table 3 depicts the association of lifestyle-related factors with obesity among primary school children. Overall, findings indicate that childhood obesity was significantly associated with having health problems, preferred food, frequency of meals taken per day, consumption of fast food, sweetened food, and soft drinks, time spent in outdoor games, as well as time spent on screen viewing. On the contrary, age and sex of the children, and sleep duration per day have no significant association with childhood obesity in the study area.

Association of lifestyle factors with child obesity (Binary logistic regression)

Binary logistic regression was executed considering the eight significant variables out of eleven variables used in bivariate statistical analysis, namely children having health problems, child preferred food, frequency of meals taken per day, consumption of fast food, sweetened food, and soft drinks, as well as time spent on outdoor games, and screen viewing. The results indicate that children having health problems, the frequency of meals taken per day, as well as time spent in outdoor games, have significant association with childhood obesity. Moreover, findings predict that children having health problems were 4.941 times more possibly to be obese compared to their counterparts (AOR = 4.41; 95% CI: 2.273-10.745; $p < 0.001$). Similarly, the risk of obesity among children having more than three times meals in a day was 24.534 times higher than that of those who had meals less than or equal to three times a day (AOR = 24.534; 95% CI: 10.024-60.046; $p < 0.001$). Finally, children who spent less time in outdoor games have 2.736 times higher risk of being obese (AOR = 2.736; 95% CI: 1.242-6.028; $p < 0.05$) than those who remain active physically by spending more time in outdoor games.

Table 3. Association of lifestyle-related factors with obesity among school children using bivariate analysis

Independent variables	Children's BMI		Chi-square value	*p*-value
	Non-obese	Obese		
Age of the children (in years)				
≤6	50 (54.3)	42 (45.7)	1.228	0.541
7-8	48 (53.3)	42 (46.7)		
≥9	46 (61.3)	29 [(38.7)		
Sex of the children				
Girl	65 (52.8)	58 (47.2)	0.972	0.324
Boy	79 (59.0)	55 (41.0)		
Having health problems of the children				
No	104 (67.1)	51 (32.9)	19.411	<0.001*
Yes	40 (39.2)	62 (60.8)		
Preferred food of the children				
Food away from home	72 (47.4)	80 (52.6)	11.332	<0.001*
Homemade food	72 (68.6)	33 (31.4)		
Frequency of meals taken per day				
≤ 3 times	102 (91.9)	9 (8.1)	1.020E2a	<0.001*
>3 times	42 (28.8)	104 (71.2)		
Consumption of fast food				
Irregular	123 (66.1)	63 (33.9)	27.866	<0.001*
Regular	21 (29.6)	50 (70.4)		
Consumption of sweetened food				
Irregular	110 (64.3)	61 (35.7)	14.277	<0.001*
Regular	34 (39.5)	52 (60.5)		
Consumption of soft drinks				
Irregular	121 (65.1)	65 (34.9)	22.247	<0.001*
Regular	23 (32.4)	48 (67.6)		
Time spent in outdoor games per day				
Physically active (<1 hour)	84 (68.3)	39 (31.7)	14.396	<0.001*
Physically inactive (≥1 hour)	60 (44.8)	74 (55.2)		
Time spent in screen viewing per day				
≤2 hour	103 (66.0)	53 (34.0)	16.095	<0.001*
>2 hours	41 (40.6)	60 (59.4)		
Sleep duration per day				
<9 hours	61 (61.6)	38 (38.4)	2.039	0.153
≥9 hours	83 (52.5)	75 (47.5)		

** Significant at 5%*

Discussion

Childhood obesity has recently been an important concern worldwide and seems to play a significant role in the development of many childhood diseases (Rauniyar et al., 2018). The present study aimed to explain the association of lifestyle-related factors with obesity among primary school children in the Khulna City of Bangladesh. Findings reveal that in the study area, 44 percent of the children were obese as the study was conducted in the urban areas. The higher rate of childhood obesity and overweight was also noted in prior studies (Akter et al., 2020; Zabeen et al., 2018) conducted in Bangladesh among children between the age group of five to eighteen years. Results of this study also reveal that having health problems, frequency of meals taken per day, and time spent playing outdoor games are the significant lifestyle-related factors correlated with child obesity.

We found that children with health problems were at a higher risk of being obese than their counterparts which corresponds with the findings of earlier studies (Bertapelli et al., 2016; Lee & Ham, 2015). This fact might be explained by the findings of a prior study (Hering et al., 2009) that found obesity among children is associated with increased healthcare use.

We also found that the prevalence rate of obesity was higher among the children who preferred food away from home compared to those children who preferred homemade food though it failed to exhibit any significant association. Inconsistent with this finding, prior studies conducted in China (Ma et al., 2021) and Portugal (Machado-Rodrigues et al., 2018) found that a higher frequency of eating outside per week was significantly associated with a higher prevalence of obesity amongst children. The possible reason for this discrepant finding might be that we only considered the type of food children preferred rather than emphasizing the nature and calorie content of the given meals.

Table 4. Child obesity and its predictors (Binary logistic regression)

Factors	Coefficient (B)	*p*-value	AOR	95% CI
Children suffering from chronic diseases				
No(ref)				
Yes	1.598	<0.001*	4.941	2.273-10.745
Children's preferred food				
Food away from home(ref)				
Homemade food	-0.121	0.762	0.886	0.405-1.938
Frequency of meals taken per day				
≤ 3 times(ref)				
>3 times	3.200	<0.001*	24.534	10.024-60.046
Fast food consumption				
Irregular(ref)				
Regular	-0.807	0.079	0.446	0.182-1.098
Sweetened foods consumption				
Irregular(ref)				
Regular	0.279	0.531	1.322	0.552-3.162
Soft drinks consumption				
Irregular(ref)				
Regular	-0.688	0.129	0.503	0.207-1.221
Time spent in outdoor games				
Physically active (<1 hour) (ref)				
Physically inactive (≥1 hour)	1.006	0.013*	2.736	1.242-6.028
Time spent in screen viewing per day				
≤2 hour(ref)				
>2 hours	0.337	0.404	1.401	0.635-3.093

*Significant at 5%

We noted that children who have more than three meals in a day have a higher chance of being obese than others. It is also found in another study (Lee & Ham, 2015) that the significant effect of overeating among children increased the risk of obesity development. Frequent taking of meals might be influenced by neural and hormonal regulatory control which plays a significant role in hunger and satiety as well as sensory stimulation, gastrointestinal signals, and circulating hormones further contribute to food intake (Scaglioni et al., 2018).

Frequent consumption of fast food was recognized as a significant predictor of obesity among school children in previous studies conducted in Saudi Arabia, America, Bangladesh, and China (Almuhanna et al., 2014; Emond et al., 2020; Habib et al., 2020; Zhao et al., 2017). However, the present study found no significant association between the consumption of fast food and childhood obesity. Inconsistent with the findings of prior studies (Katzmarzyk et al., 2016; Keller & Bucher, 2015) the present study did not find any significant association between childhood obesity with sweetened food and soft drinks consumption. The possible reason for this finding of the present study might be that we included whether children consume fast foods, sweetened foods, and soft drinks on a regular or irregular basis without considering the quantity.

We also observed that children who spent a longer period playing outdoor games have a lower risk of being obese and this is aligned with previous studies (Amidu et al., 2013; Hammad & Berry, 2017; Neto et al., 2014). Reduction of open space for playgrounds due to unplanned and rapid urbanization in Khulna City can be a factor in

reducing the physical activity of the children, which ultimately increases the risk of obesity amongst children (Bhuiyan et al., 2013).

Time spent on TV or screen viewing has a significant relationship with childhood obesity which corresponds with some existing literature (Hossain et al., 2020; Zhang et al., 2020) that found watching TV for more than 2 to 3 hours per day tended to increase the chances of obesity among children. However, the current study did not find any significant association between TV/screen viewing and the prevalence of child obesity.

The strength of the current study is that it covers lifestyle-related factors to assess their relationship with obesity among the younger age group, as childhood obesity is becoming a growing public health concern throughout the world. However, the potential limitation of the present study is that it was conducted in a particular area. That is, it could not be generalized to the entire young population of Bangladesh. In addition, respondents were selected following the purposive sampling technique which might raise the question of biasness.

Conclusion

The study aimed to explain the association of lifestyle-related factors with obesity amongst primary school children in the Khulna City of Bangladesh. Findings indicated that children having health problems, higher frequency of meals taken per day, and less time spent playing outdoor games were the significant predictors of childhood obesity. The study recommends that parents should motivate their children to adopt and habituate a healthy lifestyle, e.g., reducing sedentary activities and motivating them to be active physically. Moreover, adequate playgrounds for children that can help to prevent obesity and should be considered on a priority basis in dealing with the management of childhood obesity. Further research can be carried out in a broader aspect at national level on young children to generalize the effect of lifestyle-related factors on childhood obesity.

Conflict of Interests

The author declares no conflict of interest.

References

Abduelkarem, A. R., Sharif, S. I., Bankessli, F. G., Kamal, S. A., Kulhasan, N. M., & Hamrouni, A. M. (2020). Obesity and its associated risk factors among school-aged children in Sharjah, UAE. *PLoS ONE*, *15*(6), e0234244. doi: https://doi.org/10.1371/journal.pone.0234244

Ahmed, H. S., Khalid, M. E., Osman, O. M., Ballal, M. A., & Al-Hashem, F. H. (2016). The association between physical activity and overweight and obesity in a population of children at high and low altitudes in Southwestern Saudi Arabia. *Journal of Family & Community Medicine*, *23*(2), 82. doi: 10.4103/2230-8229.181011

Akter, S. Rahman, M. H. & Razu, S. R. (2020). Socio-demographic factors associated with obesity among primary school children: A cross-sectional survey from Khulna district of Bangladesh. *Journal of Population and Development*, *2*, 84-96.

Al-Agha, A. E., Nizar, F. S., & Nahhas, A. M. (2016). The association between body mass index and duration spent on electronic devices in children and adolescents in Western Saudi Arabia. *Saudi Medical Journal*, *37*(4), 436. doi: 10.15537/smj.2016.4.15018

Al-Ghamdi, S. H. (2013). The association between watching television and obesity in children of school-age in Saudi Arabia. *Journal of Family & Community Medicine*, *20*(2), 83. doi: 10.4103/2230-8229.114767

Al-Hazzaa, H. M., & Albawardi, N. M. (2019). Activity energy expenditure, screen time and dietary habits relative to gender among Saudi youth: Interactions of gender with obesity status and selected lifestyle behaviours. *Asia Pacific Journal of Clinical Nutrition*, *28*(2), 389-400. doi: 10.6133/apjcn.201906_28(2).0022.

Al-Hazzaa, H. M., Musaiger, A. O., Abahussain, N. A., Al-Sobayel, H. I., & Qahwaji, D. M. (2012). Prevalence of short sleep duration and its association with obesity among adolescents 15-to 19-year olds: A cross-sectional study from three major cities in Saudi Arabia. *Annals of Thoracic Medicine*, *7*(3), 133. doi: 10.4103/1817-1737.98845

Al-Nuaim, A. A., Al-Nakeeb, Y., Lyons, M., Al-Hazzaa, H. M., Nevill, A., Collins, P., & Duncan, M. J. (2012). The prevalence of physical activity and sedentary behaviours relative to obesity among adolescents from Al-Ahsa, Saudi Arabia: Rural versus urban variations. *Journal of Nutrition & Metabolism*, 2012:417589. doi: 10.1155/2012/417589.

Alazzeh, A. Y., AlShammari, E. M., Smadi, M. M., Azzeh, F. S., AlShammari, B. T., Epuru, S., Banu, S., Bano, R., Sulaiman, S., Alcantara, J. C., Syed, A. A., & Qiblawi, S. (2018). Some socioeconomic factors and lifestyle habits influencing the prevalence of obesity among adolescent male students in the hail region of Saudi Arabia. *Children*, *5*(3), 39. doi: 10.3390/children5030039

Alghadir, A. H., Gabr, S. A., & Iqbal, Z. A. (2016). Television watching, diet and body mass index of school children in Saudi Arabia. *Pediatrics International*, *58*(4), 290-294. doi: 10.1111/ped.12834

Almuhanna, M. A., Alsaif, M., Alsaadi, M., & Almajwal, A. (2014). Fast food intake and prevalence of obesity in school children in Riyadh City. *Sudanese Journal of Paediatrics*, *14*(1), 71. PMC4949920

Amidu, N., Owiredu, W., Saaka, M., Quaye, L., Wanwan, M., Kumibea, P., Zingina, F., & Mogre, V. (2013). Determinants of childhood obesity among basic school children aged 6–12 years in Tamale Metropolis. *Journal of Medical and Biomedical Sciences*, *2*(3), 26-34. doi: 10.4314/jmbs.v2i3.5

Bertapelli, F., Pitetti, K., Agiovlasitis, S., & Guerra-Junior, G. (2016). Overweight and obesity in children and adolescents with Down syndrome-prevalence, determinants, consequences, and interventions: A literature review. *Research in Developmental Disabilities*, *57*, 181-192. doi: 10.1016/j.ridd.2016.06.018

Bhuiyan, M. U., Zaman, S., & Ahmed, T. (2013). Risk factors associated with overweight and obesity among urban school children and adolescents in Bangladesh: A case-control study. *BMC Pediatrics*, *13*(1), 1-6. doi: https://doi.org/10.1186/1471-2431-13-72

Desalew, A., Mandesh, A., & Semahegn, A. (2017). Childhood overweight, obesity and associated factors among primary school children in dire dawa, eastern Ethiopia; A cross-sectional study. *BMC Obesity*, *4*(1), 1-10. doi: 10.1186/s40608-017-0156-2

Emond, J. A., Longacre, M. R., Titus, L. J., Hendricks, K., Drake, K. M., Carroll, J. E., Cleveland, L. P., & Dalton, M. A. (2020). Fast food intake and excess weight gain over a 1-year period among preschool-age children. *Pediatric Obesity*, *15*(4), e12602. doi: 10.1111/ijpo.12602

Ganle, J. K., Boakye, P. P., & Baatiema, L. (2019). Childhood obesity in urban Ghana: Evidence from a cross-sectional survey of in-school children aged 5–16 years. *BMC Public Health*, *19*(1), 1-12. doi: https://doi.org/10.1186/s12889-019-7898-3

Habib, M. A., Chowdhury, A. I., Hossen, K., Kibria, T., & Hossain, M. (2020). Fast food intake and prevalence of overweight/obesity in students: Do eating habits have a differential impact on gender? *Journal of Contemporary Medical Research*, *7*(6), F4-F9. doi: http://dx.doi.org/10.21276/ijcmr.2020.7.6.30

Hajian-Tilaki, K., & Heidari, B. (2013). Childhood obesity, overweight, socio-demographic and life style determinants among preschool children in Babol, northern Iran. *Iranian Journal of Public Health*, *42*(11), 1283. PMC4499070

Hammad, S. S., & Berry, D. C. (2017). The child obesity epidemic in Saudi Arabia: A review of the literature. *Journal of Transcultural Nursing*, *28*(5), 505-515. doi: https://doi.org/10.1177/1043659616668398

Hasanat, M. A., Rauniyar, B. K., Jahan, S., Sultana, N., Hasan, M., Rahman, M. A., Aktar, Y., & Fariduddin, M. (2019). Lifestyle has significant influence over obesity among school children in Bangladesh. *Current Research in Diabetes & Obesity Journal*, *10*(1), 555-776. doi: https://doi.org/10.19080/CRDOJ.2019.10.555776

Hassan, N. E., El-Masry, S. A., Farid, T., & Khalil, A. (2016). Influence of parental and some demographic characteristics on overweight/obesity status among a sample of Egyptian children. *Open Access Macedonian Journal of Medical Sciences*, *4*(3), 342. doi: 10.3889/oamjms.2016.088

Hering, E., Pritsker, I., Gonchar, L., & Pillar, G. (2009). Obesity in children is associated with increased health care use. *Clinical Pediatrics*, *48*(8), 812-818. doi: https://doi.org/10.1177/0009922809336072

Hills, A. P., Andersen, L. B., & Byrne, N. M. (2011). Physical activity and obesity in children. *British Journal of Sports Medicine*, *45*(11), 866-870. doi: 10.1136/bjsports-2011-090199

Hossain, M. T., Luies, S. K., & Biswas, T. (2020). Prevalence and factors associated with overweight and obesity among primary school children (9–14 years) in a selected area of Dhaka, Bangladesh: A cross-sectional study. *Indian Journal of Community Medicine: Official Publication of Indian Association of Preventive & Social Medicine*, *45*(4), 429. doi: 10.4103/ijcm.IJCM_466_19

Júlíusson, P. B., Eide, G. E., Roelants, M., Waaler, P. E., Hauspie, R., & Bjerknes, R. (2010). Overweight and obesity in Norwegian children: Prevalence and socio-demographic risk factors. *Acta Paediatrica*, *99*(6), 900-905. doi: 10.1111/j.1651-2227.2010.01730.x

Katzmarzyk, P. T., Broyles, S. T., Champagne, C. M., Chaput, J. P., Fogelholm, M., Hu, G., Kuriyan, R., Kurpad, A., Lambert, E. V., Maia, J., Matsudo, V., Olds, T., Onywera, V., Sarmiento, O. L., Standage, M., Tremblay, M. S., TudorLocke, C., & Zhao, P. (2016). Relationship between soft drink consumption and obesity in 9–11 years old children in a multi-national study. *Nutrients*, *8*(12), 770. doi: 10.3390/nu8120770

Keller, A., & Bucher, D. T. S. (2015). Sugar-sweetened beverages and obesity among children and adolescents: A review of systematic literature reviews. *Childhood Obesity*, *11*(4), 338-346. doi: 10.1089/chi.2014.0117

Koirala, M., Khatri, R., Khanal, V., & Amatya, A. (2015). Prevalence and factors associated with childhood overweight/obesity of private children in Nepal. *Obesity Research & Clinical Practice*, *9*(3), 220-227. doi: https:// dx.doi.org/10.1016/j.orcp.2014.10.219

Kuczmarski, R. J., Ogden, C. L., Guo, S. S., Grummer-Strawn, L. M., Flegal, K. M., Mei, Z., Wei, R., Curtin, L. R., Roche, A. F., & Johnson, C. L. (2002). 2000 CDC Growth Charts for the United States: Methods and development. *Vital and Health Statistics 11*, 1-190. PMID: 12043359

Lee, G., & Ham, O. K. (2015). Factors affecting underweight and obesity among elementary school children in South Korea. *Asian Nursing Research*, *9*(4), 298-304. doi: https://doi.org/10.1016/j.anr.2015.07.004

Ma, Y., Gong, W., Ding, C., Song, C., Yuan, F., Fan, J., Feng, G., Chen, Z., & Liu, A. (2021). The association between frequency of eating out with overweight and obesity among children aged 6–17 in China: A national cross-sectional study. *BMC Public Health*, *21*(1), 1-8. doi: 10.1186/s12889-021-11104-0

Machado-Rodrigues, A. M., Gama, A., Mourão, I., Nogueira, H., Rosado-Marques, V., & Padez, C. (2018). Eating away from home: A risk factor for overweight in children. *European Journal of Clinical Nutrition*, *72*(12), 1724-1727. doi: 10.1038/s41430-018-0165-3

Mahfouz, A. A., Shatoor, A. S., Khan, M. Y., Daffalla, A. A., Mostafa, O. A., & Hassanein, M. A. (2011). Nutrition, physical activity, and gender risks for adolescent obesity in Southwestern Saudi Arabia. *Saudi Journal of Gastroenterology: Official Journal of the Saudi Gastroenterology Association*, *17*(5), 318. doi: 10.4103/1319-3767.84486

Mirelman, A., Koehlmoos, T. P., & Niessen, L. (2012). Risk-attributable burden of chronic diseases and cost of prevention in Bangladesh. *Global Heart*, *7*(1). doi: 10.1016/j.gheart.2012.01.006

Neto, F. A., Eto, F. N., Pereira, T. S. S., Carletti, L., & Molina, M. d. C. B. (2014). Active and sedentary behaviours in children aged 7 to 10 years old: The urban and rural contexts, Brazil. *BMC Public Health*, *14*(1), 1-10. doi: https://doi.org/10.1186/1471-2458-14-1174

Piryani, S., Baral, K. P., Pradhan, B., Poudyal, A. K., & Piryani, R. M. (2016). Overweight and its associated risk factors among urban school adolescents in Nepal: A cross-sectional study. *BMJ Open*, *6*(5), e010335. doi: 10.1136/bmjopen-2015-010335

Rachmi, C., Li, M., & Baur, L. A. (2017). Overweight and obesity in Indonesia: Prevalence and risk factors-a literature review. *Public Health*, *147*, 20-29. doi: 10.1016/j.puhe.2017.02.002

Rahman, M., Reza, S., Islam, M., Rahman, A., & Nath, A. (2014). Prevalence of obesity and overweight among English medium school children of Dhaka City in Bangladesh. *Journal of Environmental Science and Natural Resources*, *7*(1), 63-67. doi: https://doi.org/10.3329/jesnr.v7i1.22146

Rauniyar, B., Jahan, S., Sultana, N., Hasan, M., Rahman, M. A., Aktar, Y., Fariduddin, M., & Hasanat, M. A. (2018). Prevalence of obesity is rising among primary school children in Dhaka city of Bangladesh. *Diabetes & Obesity International Journal,* 3(3), 000182.

Raychaudhuri, M., & Sanyal, D. (2012). Childhood obesity: Determinants, evaluation, and prevention. *Indian Journal of Endocrinology and Metabolism*, *16*(Suppl 2), S192. doi: 10.4103/2230-8210.104037

Saha, S., Zahid, M. K., & Rasheed, S. (2011). The study of the level of knowledge, attitude, practices (KAP) as well as the effects of school environment on the nutritional status of children (7-12) coming from affluent families in the Dhaka City in Bangladesh. *Bangladesh Journal of Nutrition*, 31-48. doi: https://doi.org/10.3329/bjnut.v24i0.14035

Scaglioni, S., De Cosmi, V., Ciappolino, V., Parazzini, F., Brambilla, P., & Agostoni, C. (2018). Factors influencing children's eating behaviours. *Nutrients*, *10*(6), 706. doi: 10.3390/nu10060706

World Health Organization. (2020). *Obesity and overweight*. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

Xu, J., Hardy, L. L., Guo, C. Z., & Garnett, S. P. (2018). The trends and prevalence of obesity and morbid obesity among Australian school-aged children, 1985–2014. *Journal of Paediatrics & Child Health*, *54*(8), 907-912. doi: 10.1111/jpc.13922

Zabeen, B., Sharmin, E., Shamayeen, Z., Khaled, N., Nahar, J., & Azad, K. (2018). Prevalence of overweight & obesity among school students from high and low-income families in Bangladesh: A cross-sectional study. *American Academy of Pediatrics*, 142 (1), 502. doi: 10.1542/peds.142.1_MeetingAbstract.502

Zhang, Y., Zhang, X., Li, J., Zhong, H., & Pan, C. W. (2020). Associations of outdoor activity and screen time with adiposity: Findings from rural Chinese adolescents with relatively low adiposity risks. *BMC Public Health*, *20*(1), 1-9. doi: https://doi.org/10.1186/s12889-020-09897-7

Zhao, Y., Wang, L., Xue, H., Wang, H., & Wang, Y. (2017). Fast food consumption and its associations with obesity and hypertension among children: Results from the baseline data of the childhood obesity study in China Mega-cities. *BMC Public Health*, *17*(1), 1-10. doi: https://doi.org/10.1186/s12889-017-4952-x